

CSCI 3650 Design and Analysis of Algorithms

Quiz I

Spring 2018

Name:.....

1. What is Computer Science?. (4 Pts.)

2. Give a *formal* definition of the term **algorithm**. (4 Pts.)

3. Consider a set of 4 men $\{A, B, C, D\}$ and a set of 4 women $\{a, b, c, d\}$. Their preference lists are given in the following tables.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| A | c | b | d | a | a | A | B | D | C |
| B | b | a | c | d | b | C | A | D | B |
| C | b | d | a | c | c | C | B | D | A |
| D | a | c | d | b | d | B | A | C | D |

Consider the following set of ordered pairs $S = \{(A, c), (B, a), (C, b), (D, d)\}$.

- (a) Is this a matching? If so, why so and if not, why not? (1 Pt.)
- (b) Is this a perfect matching? If so, why so and if not, why not? (1 Pt.)
- (c) Is this a stable matching? If so, give a short explanation and if not, give a counterexample. (3 Pts.)
4. Decide whether you think the following statement is true or false. If it is true, give a short explanation. If it is false, give a counterexample. (5 Pts.)

Consider an instance of the Stable Matching Problem in which there exists a man m and a woman w such that m is ranked first on the preference list of w and w is ranked first on the preference list of m . Then in **every** stable matching S for this instance, the pair (m, w) belongs to S .

5. Prove that $2n^3 - 8n^2 = \Omega(n^3)$ using the basic definition of Ω . Clearly specify c and n_0 . Do **not** use calculus. Also, no need to use mathematical induction; but, you may use induction if you want to. (6 Pts.)

6. Consider the following 6 functions of n . Sort them in ascending order of growth rate. Write them one per line with the slowest growing function in the first line and the fastest growing function in the last line. No need to prove anything. (6 Pts.)
 $n!, (1.2)^n, n\sqrt{n}, n^{1.2}, n^n, n \log n,$